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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/666,671	09/17/2003	Hongqin Shi	P118-US	8251
23494 7590 01/19/2007 TEXAS INSTRUMENTS INCORPORATED P O BOX 655474, M/S 3999 DALLAS, TX 75265			EXAMINER VINH, LAN	
			ART UNIT	PAPER NUMBER
			1765	
SHORTENED STATUTORY PERIOD OF RESPONSE		MAIL DATE	DELIVERY MODE	
3 MONTHS		01/19/2007	PAPER	

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/666,671

Applicant(s)

SHI ET AL.

Examiner

Lan Vinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 November 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3,5-21,24-30,32-54,56-64 and 66-71 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 63,64 and 66-71 is/are allowed.
- 6) ☒ Claim(s) 1-2, 5-21,26-30,32-34, 37-54 and 56-62 is/are rejected.
- 7) ☒ Claim(s) 3,24,25,35 and 36 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/1/2006 has been entered.

2. The indication of allowable subject matter in claims 1-2, 5-21, 26-29 have been withdrawn in view of the newly cited reference of Buskirk et al (US 2002/0011463 A1)

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-2, 5-6, 10-12, 15, 17, 26-27 are rejected under 35 U.S.C. 102(b) as being anticipated by Buskirk et al (US 2002/0011463 A1)

Buskirk discloses a dry cleaning process. The process comprises the steps of:

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loading a microelectronic device/microstructure into an etch chamber of the etch system, wherein the sample comprises silicon /sacrificial material and a platinum layer/ structural materials (page 2, paragraph 0020, paragraph 0033, 0035)

providing a etchant recipe comprising XeF_2 vapor to etch the silicon/sacrificial layer (page 2, paragraph 0019, 0020)

measuring an amount of a etchant/chemical species in the process (page 2, paragraph 0036)

determining the time and condition for the reactive halide etch and empirically determining the nature of the etching while varying the time and contacting conditions such as concentration of the etching agent to identify the process condition (page 3, paragraph 0039), which reads on determining a feed time based on the measurement and further etching the sacrificial material by providing an additional amount of the spontaneous vapor phase etchant recipe to the etch system based on the determined feeding time to continue the etch process

The limitation of claims 2, 5-6, 26-27 have been discussed above

Regarding claims 10-11, Buskirk discloses that the etchant comprises an inert/diluent gas (page 3, paragraph 0043)

Regarding claim 15, Buskirk discloses performing process in cycles (page 1, paragraph 0016), which reads on repeating the steps of the process

Regarding claim 17, Bskitk discloses that the etchant has a pressure of 50 mTorr-2 Torr (page 2, paragraph 0035)

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5. Claims 30, 32-34, 37-39, 42-45, 48-50 are rejected under 35 U.S.C. 102(b) as being anticipated by Buskirk et al (US 2002/0011463 A1)

Buskirk discloses a dry cleaning process. The process comprises the steps of:

loading a microelectronic device/microstructure into an etch chamber of the etch system, wherein the sample comprises silicon /sacrificial material and a platinum layer/ structural materials (page 2, paragraph 0020, paragraph 0033, 0035)

providing a etchant recipe comprising XeF_2 vapor/noble gas halide to etch the silicon/sacrificial layer (page 2, paragraph 0019, 0020), wherein at 10 seconds/first time the total flow rate of the reactive halide gas can be about 1 sccm and at 10 seconds/second time the total flow rate of the reactive gas can be about 10 sccm

The limitations of claims 32-34, 42-43, 50 have been discussed above

Regarding claims 37-39, Buskirk discloses that empirically determining the nature of the etching while varying the time and contacting conditions such as concentration of the etching agent to identify the process condition

Regarding claims 44-45, Buskirk discloses that the etchant comprises an inert/diluent gas (page 3, paragraph 0043)

Regarding claims 48-49, Buskirk discloses that the platinum layer/structural layer remains after the silicon layer is removed

6. Claims 53-54, 58-59, 61-62 are rejected under 35 U.S.C. 102(b) as being anticipated by Buskirk et al (US 2002/0011463 A1)

Buskirk discloses a dry cleaning process. The process comprises the steps of:

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providing a etchant recipe comprising XeF_2 vapor/noble gas halide to etch the silicon/sacrificial layer (page 2, paragraph 0019, 0020), determining the time and condition for the reactive halide etch and empirically determining the nature of the etching while varying the time and contacting conditions such as concentration of the etching agent/etchant recipe to identify the process condition (page 3, paragraph 0039), wherein at 10 seconds/first time the total flow rate of the reactive halide gas can be about 1 sccm and at 10 seconds/second time the total flow rate of the reactive gas can be about 10 sccm

The limitation of claim 54, 58-59 have been discussed above

Regarding claims 61-62, Buskirk discloses that the etchant comprises an inert/diluent gas (page 3, paragraph 0043)

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 7-8, 40-41, 56-57 is rejected under 35 U.S.C. 103(a) as being unpatentable over Buskirk et al (US 2002/0011463 A1) in view of Tai et al (US 6,436,229)

Buskirk method has been described above. Unlike the instant claimed invention as per claims 7-8, 40-41, 56-57, Buskirk fails to disclose using BrF_3 as a vapor etchant

Tai discloses a method for etching comprises the step of etching silicon using BrF_3

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(col 3, lines 10-15)

One skilled in the art at the time the invention was made would have found it obvious to substitute Buskirk xenon difluoride vapor etchant with BrF₃ as per Tai because Tai discloses that BrF₃ has higher etching efficiency than that of xenon difluoride and BrF₃ is also cost effective when compared with the use of xenon difluoride (col 3, lines 5-10)

9. Claims 9, 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buskirk et al (US 2002/0011463 A1) in view of Zhang et al (US 6,162,585)

Buskirk method has been described above. Unlike the instant claimed inventions as per claims 9, 60, Buskirk disclose using a vapor etchant recipe comprises of xenon difluoride instead of HF

Zhang discloses a method for etching using vapor HF (col 5, lines 39-40)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Buskirk method by using vapor HF etching as per Zhang because Zhang discloses that the allowable duration of vapor HF etching allows deeper etch (col 5, lines 63-67)

10. Claims 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buskirk et al (US 2002/0011463 A1) in view Tai et al (US 6,436,229)

Buskirk method has been described above. Unlike the instant claimed inventions as per claims 13-14, Buskirk fails to disclose the steps of preparing the etchant in vapor

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reservoir /exchange chamber and supplying the etchant through a loop that passes through the etch-chamber

Tai discloses the step of preparing the etchant in vapor reservoir 120/exchange chamber and supplying the etchant through a loop that passes through the etch-chamber 110 (fig. 1A)

One skilled in the art at the time the invention was made would have found it obvious to modify Buskirk method by adding the step of preparing the etchant in vapor reservoir /exchange chamber and supplying the etchant through a loop that passes through the etch-chamber as conventional known in the art as taught by Tai

11. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Buskirk et al (US 2002/0011463 A) in view of Chinn et al (US 6,666,979)

Buskirk method has been described above. Unlike the instant claimed invention as per claim 16, Buskirk fails to disclose coating the microstructure with a SAM

Chinn discloses a method for dry etch comprises the step of coating the microstructure with a SAM (col 11, lines 18-45)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Buskirk method by coating the microstructure with a SAM to prevent stiction during handling (col 11, lines 16-19)

12. Claims 18-21, 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buskirk et al (US 2002/0011463 A1) in view of Han et al (US 6,740,247)

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Buskirk method has been described above. Unlike the instant claimed inventions as per claims 18-21, 46-47, Buskirk fails to disclose that the diluent gas has a partial pressure from 20-700 Torr

Han discloses a method for HF vapor cleaning/etching comprises the step using a nitrogen /diluent gas has a partial pressure from 10-500 Torr (col 7, lines 55-57)

One skilled in the art at the time the invention was made would have found it obvious to modify Buskirk method by using a nitrogen/diluent gas has a partial pressure of 10-500 Torr to enable stabilization of the operating chamber pressure as taught by Han (col 7, lines 55-58)

13. Claims 28-29, 51-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buskirk et al (US 2002/0011463 A1) in view of Chen et al (US 6,159,851)

Buskirk method has been described above. Unlike the instant claimed invention as per claims 28-29, 51-52, Buskirk fails to disclose that the structural material comprises a elemental metal and a metal nitride

Chen discloses a method for forming a semiconductor device comprises the step of forming a TiN layer with a primary conductive layer (col 6, lines 4-6)

Thus, one skilled in the art at the time the invention was made would have found it obvious to modify Buskirk method by forming a metal nitride as per Chen because Chen discloses that the TiN provides conformal adherent coating on a lower metal (col 5, lines 14-16)

Allowable Subject Matter

14. Claims 3, 24-25, 35-36 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 63-64, 66-71 allowed.

The following is an examiner's statement of reasons for allowance: Regarding claim 63, the cited prior art of record fails to disclose or suggest a method of etching a plurality of microstructure comprises a step of etching a second microstructure in a second etching process using the etchant recipe based on the collected data of the parameter in the first etching process and wherein the parameter is a detected chemical species during the etch, in combination with the rest of the limitations of claim 63

Response to Arguments

15. Applicant's arguments which dispute that the plasma etchant comprises of BCl_3 is not a spontaneous vapor phase etchant as required by claim 30 have been considered but are moot in view of the new ground(s) of rejection based on Buskirk et al (US 2002/0011463 A1) since Buskirk discloses providing a etchant recipe comprising XeF_2 vapor to etch the silicon/sacrificial layer (page 2, paragraph 0019, 0020)

Applicants also argue that the Lebouitz reference does not disclose providing an etchant recipe that is a spontaneous vapor phase etchant to the etch chamber over time, wherein an amount of the etchant is varied when a change of a measured

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parameter is beyond a predetermined value during the etching, and wherein the amount of the etchant is varied from a first amount to a second amount and wherein both the first and second amounts are not 0. This argument is moot in view of the new ground(s) of rejection based on Buskirk et al (US 2002/0011463 A1) since Buskirk discloses providing a etchant recipe comprising XeF_2 vapor/noble gas halide to etch the silicon/sacrificial layer (page 2, paragraph 0019, 0020), determining the time and condition for the reactive halide etch and empirically determining the nature of the etching while varying the time and contacting conditions such as concentration of the etching agent/etchant recipe to identify the process condition (page 3, paragraph 0039), wherein at 10 seconds/first time the total flow rate of the reactive halide gas can be about 1 sccm and at 10 seconds/second time the total flow rate of the reactive gas can be about 10 sccm.

Applicant's arguments, see pages 11-12 of the response, filed 11/1/2006, with respect to rejection of claim 63 based on Leboutitz and Winningham have been fully considered and are persuasive. The rejection(s) has been withdrawn.

Conclusion

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 571 272 1471. The examiner can normally be reached on M-F 8:30-5:30 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to be 'LV', is located above the typed name 'LV'.

LV
January, 2007